

Premises of Neogene Correlation in the Northern Part of the Circum-Pacific

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CONSIDERABLE ADVANCES have been achieved in subdivision of the marine Neogene of the northern part of the Circum-Pacific area. This problem was rather thoroughly elucidated at the First International Congress on Pacific Neogene Stratigraphy held in Tokyo in 1976 (SAITO & UJIE, 1977). Nevertheless, there are still many questions that remain obscure. That is why I should like to concentrate upon some general points including some of the difficulties we may face in correlating the marine Cenozoic of northern regions.

It is well known that remains of the fossil groups usually used for subdividing the stratigraphic sections in the Arctic and Boreal regions are not considered reliable for long distance correlations due to their strong dependence upon facies conditions. These kinds of fossils are: mollusks, benthonic foraminifers, echinoids, and plant remains. The use of these groups allows us, in fact, to compile only regional stratigraphic schemes. Unfortunately the more widespread fossil groups such as planktonic foraminifers and nannoplankton that are so effectively used in lower latitudes are rarely observed in the Arctic and Boreal regions.

Secondly, I want to emphasize the fact that until recently lithostratigraphic subdivisions such as formations and suites have been mapped in many countries. Analysis shows that their boundaries are frequently diachronous and this, naturally, makes correlation difficult. Many papers devoted to this problem have been written in the Soviet Union, North America, and Japan.

Hence, these essential conclusions follow. First of all, we have to compile regional stratigraphic schemes using the "working" paleontological groups that exist, in fact (benthonic organisms, in particular), in every region. In order to single out chronostratigraphic subdivisions, such as horizons or regiostages, but not lithostratigraphic ones, we should use such a change of assemblages that would be specified, first of all, by the evolutionary stages of these groups and stages of development of the basin. The regional sequences are compiled in various climatic zones and in areas with different geological histories.

The second task is correlation of these sequences with one another, and then correlation of these with the time scales of warm-water areas. Such a correlation can provide a reliable age determination of horizons, and, as a result, can help in deciphering geological events of the past. At present we use various groups, such as mollusks, foraminifers, and diatoms as well as climatic datum remarks, for interregional correlations. True, their correlative role is frequently effective at only certain levels, but abundant materials from various regions give us hope that these correlations will be gradually perfected.

The study of fossil faunas from the North Pacific shows that we can now outline a number of levels that can be traced from Alaska and Chukotka southeastward to California and southwestward to Japan (GLADENKOV, 1977). For example, the upper Paleogene horizon including the bivalve mollusks *Papyridea harrimani* Dall, *Yoldia watasei* Kanehara, etc., is well observed in Kamchatka, Sakhalin, Japan, and possibly in North America. The lower Pliocene horizon with the bivalves *Fortipecten takahashii* (Yokoyama) and *F. hallae* (Dall) and often with the diatom *Denticula kamtschatica* Zabelina, etc., and the Pleistocene horizon (with the bivalve *Portlandia arctica* Gray and Recent assemblages) are well pronounced in all of the regions mentioned above.

Some of the other levels distinguished by means of various fossil groups were observed in only two or three regions. They are:

1) The lower Miocene level with the bivalves *Yoldia tokunagai* Yokoyama and *Malletia intermis* Yokoyama which can be recognized in northern Japan, Sakhalin, and Kamchatka.

2) The middle Miocene level containing the diatoms *Stephanopyxis schenckii* Kanaya and *Denticula lauta* Bailey, the foraminifer *Ammonia tochiensis* (Uchio) is found in Japan, Sakhalin, and Kamchatka. In Sakhalin the planktonic foraminifer *Globorotalia linguaensis* Bolli appears to be confined to this level.

3) The middle Miocene level with the foraminifers *Brizalina pseudospissa* Kleinpell and *Cibicides altamira-*

ensis Kleinpell, and the bivalve *Securella panzana* (Anderson & Martin) has been recognized in California and in Kamchatka.

4) The upper Miocene level with the bivalve *Mytiloconcha coalingensis* (Arnold), etc., can be identified in California and in Kamchatka.

5) An upper Pliocene horizon with the bivalve *Astarte diversa* Dall and the diatom *Melosira albicans* Sheshukova can be recognized in Alaska and in Kamchatka.

In all of these regions a horizon associated with the climatic optimum of the middle Miocene can also be recognized. This level is identified by a high percentage of *Fagus* in palynological spectra as well as by other changes in the fossil flora and fauna.

The correlation of regional horizons with the world-wide sequence is rather tentative as yet. Planktonic calcareous microfaunas present in some layers are certain to aid in correlation, but the most precise data are likely to be obtained through study of groups with siliceous skeletons. So, these groups are currently the focus of attention. In some cases paleomagnetic data and radiological dating are used for correlation. But, at the present time, these data are not numerous.

As for the correlation with the world-wide Neogene scale, of paramount importance are the fossil faunas from Japan and California. These have an intermediate position between the sequences of the Boreal region to the north and warm water regions to the south.

If there are no data for direct correlation of the regional schemes for various regions, each of the sequences can be correlated separately with the world-wide Neogene scale. With these results, the regional scales can then be corre-

lated with each other. Such correlations, though logical, are indirect and have to be carefully checked.

In 1976 at the First International Congress on the Pacific Neogene Stratigraphy, the Working Group of Chronostratigraphy of the North Pacific was organized (ARMENTROUT, 1977). This group was an outgrowth of the technical sessions on Mollusca. The papers from this session are to be found elsewhere in this issue. The program of this group, formulated by Dr. R. C. Allison and myself, is aimed at compilation of detailed regional sequences of on-shore marine basins followed by the description of stages and analysis of their paleontological characteristics. Also of importance is the correlation of regional sequences of various regions and comparison of them with the Neogene scale of warm water areas. It is anticipated that scientists from the Soviet Union, the United States, Canada, Mexico, and Japan will participate in this joint effort. It is hoped that this cooperation will facilitate the compilation of a universal Cenozoic scale, for the entire Pacific sector. Geological theory and practice have been in need of such a scale.

Literature Cited

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